

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)	
)	
Use of Spectrum Bands Above 24 GHz For)	GN Docket No. 14-177
Mobile Radio Services)	
)	
Establishing a More Flexible Framework to)	IB Docket No. 15-256
Facilitate Satellite Operations in the 27.5-28.35)	
GHz and 37.5-40 GHz Bands)	
)	
Petition for Rulemaking of the Fixed Wireless)	
Communications Coalition to Create Service)	RM-11664
Rules for the 42-43.5 GHz Band)	
)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90,)	
95, and 101 To Establish Uniform License)	WT Docket No. 10-112
Renewal, Discontinuance of Operation, and)	
Geographic Partitioning and Spectrum)	
Disaggregation Rules and Policies for Certain)	
Wireless Radio Services)	
)	
Allocation and Designation of Spectrum for)	
Fixed-Satellite Services in the 37.5-38.5 GHz,)	
40.5-41.5 GHz and 48.2-50.2 GHz Frequency)	IB Docket No. 97-95
Bands; Allocation of Spectrum to Upgrade)	
Fixed and Mobile Allocations in the 40.5-42.5)	
GHz Frequency Band; Allocation of Spectrum)	
in the 46.9-47.0 GHz Frequency Band for)	
Wireless Services; and Allocation of Spectrum)	
in the 37.0- 38.0 GHz and 40.0-40.5 GHz for)	
Government Operations)	

**COMMENTS OF LOCKHEED MARTIN CORPORATION
IN RESPONSE TO PETITIONS FOR RECONSIDERATION**

INTRODUCTION

Lockheed Martin Corporation (“Lockheed Martin”) hereby submits these comments responding to certain Petitions for Reconsideration (“Petitions”) of the Commission’s Report &

Order (“*Report and Order*”) in the above-captioned proceedings.¹ Lockheed Martin acknowledges the efforts of the Commission in these proceedings, taking advantage of the propagation characteristics at millimeter wavelengths, to establish a regime to permit flexible deployment of a wide variety of system architectures, which may include terrestrial, airborne, and satellite infrastructure solutions, using frequency bands at 24 GHz and above (“millimeter wave” or “mmW bands”). Lockheed Martin, however, is concerned that the Commission failed to strike the right balance in the *Report and Order* among existing and potential services. To that end, Lockheed Martin supports the Petitions of several parties, requesting the Commission to i) require explicitly that new Upper Microwave Flexible Use Service (“UMFUS”) licensees in the 27.5-28.35 GHz band (“28 GHz band”) comply with the International Telecommunication Union (“ITU”) Radio Regulations regarding skyward emissions, and ii) address meaningfully the issue of potential aggregate harmful interference from UMFUS operations to ensure protection of Fixed-Satellite Service (“FSS”) space station receivers.² More specifically, Lockheed Martin agrees with those petitioners that argue that the Commission should better promote real sharing of the 28 GHz band by adopting additional measures regarding the potential for aggregate UMFUS emissions to interfere with FSS satellite receivers.

Lockheed Martin also supports the Petitions by Boeing³ to prohibit the use of omnidirectional transmit antennas in the 28 GHz and 37/39 GHz bands and by SES/O3B to establish a

¹ Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, GN Docket No. 14-177, Report and Order and Further Notice of Proposed Rulemaking, FCC 16-89 (Jul. 14, 2016) (“*Further Notice*” or “*Report and Order*”).

² SES Americom, Inc. (“SES”) and O3B Limited (“O3b”), Petition for Reconsideration, filed Dec. 14, 2016; Satellite Industry Association (“SIA”), Petition for Reconsideration, filed Dec. 14, 2016.

³ The Boeing Company (“Boeing”), Petition for Reconsideration, filed Dec. 14, 2016.

database of UMFUS stations. Each of the foregoing measures would help to better balance the regulatory framework in the bands and provide the increased regulatory certainty and information necessary to allow operators – whether terrestrial, airborne, or satellite – to plan and deploy new services increasing the use of the spectrum.

DISCUSSION

A. The Commission Should Rebalance the UMFUS Regulations in the 28 GHz Band to Better Promote Intensive Use of the Band

The Commission must take into account the United States' international treaty obligations under the ITU Radio Regulations when establishing rules for domestic radio services. Consistent with the ITU Radio Regulations, non-U.S.-licensed space stations may have coverage of the United States, at least in part, while providing service to customers located in neighboring countries. For example, in the 28 GHz band, emissions from an earth station in Windsor, Canada or Juarez, Mexico to an FSS satellite receiver, *i.e.*, FSS (Earth-to-space) emissions, would, as a matter of technical necessity, occur in a receive beam with at least partial coverage of territory in the United States. The FSS satellite receiver would be vulnerable to potential, particularly aggregate, interference from skyward emissions generated by UMFUS stations and terminals from the United States.

Lockheed Martin and other commenters demonstrated that under the ITU Radio Regulations the United States is obligated to ensure that any non-U.S.-licensed satellites, which may reflect either significant U.S. export or launch business, serving Canada or Mexico are protected from harmful interference resulting from UMFUS operations in the United States permitted by the Commission. Further, consistent with the ITU Radio Regulations, the United States must immediately eliminate harmful emissions should they occur to *any* non-U.S.-licensed

satellite that has coverage of the United States. The Commission adopted a UMFUS framework in the 28 GHz band that lacks a mechanism to address the real potential for harmful interference from future UMFUS operations to FSS space stations' receipt of Earth-to-space emissions. Lockheed Martin believes the *Report and Order* did not strike the right balance because these non-U.S.-licensed systems have international co-primary status. Protection of international satellite receivers with coverage of the United States from harmful interference caused by other co-primary services such as fixed and mobile stations that the Commission chooses to authorize in the 28 GHz band is a treaty obligation, and any failure by the United States to provide that protection may have reciprocity implications.

Several parties have petitioned the Commission to reconsider its failure to provide for appropriate protection of non-U.S. licensed satellite receivers in the 28 GHz band from aggregate UMFUS transmissions. Specifically, these petitioners request that the Commission recognize its international treaty obligations discussed above and meaningfully address aggregate interference as part of this proceeding by conditioning UMFUS licenses appropriately.

In the run-up to the issuance of the *Report and Order*, Lockheed Martin and other interested parties raised this issue, and demonstrated that the issue of UMFUS interference – particularly aggregation of terrestrial emissions within a non-U.S. satellite receiver's field of view – had not been sufficiently addressed in the Commission's record to that date, and that there was no convergence in the record on either the criteria to be used to assess the problem or on the ability of international FSS space station receivers to be protected from UMFUS aggregate transmissions.⁴ The parties emphasized this to be a matter that had treaty implications for the

⁴ See, e.g., *Ex Parte* Letter of Lockheed Martin Corporation, GN Docket No. 14-177, *et al.*, at 1, 2-5 (filed June 24, 2016).

United States government under the ITU Radio Regulations, as the FSS space station receivers subject to the threat include, but are not limited to, as an extreme example, space stations that are neither licensed by the Commission nor serving U.S.-based earth stations.⁵

In its *Report and Order*, the Commission “recognize[d]” that the United States needs to protect non-U.S. licensed FSS networks in the 28 GHz band. The Commission stated, without elaboration, that the “framework” for such protection exists in other bands shared by FSS and terrestrial services.⁶ The Commission, however, concluded that it “is not violating any U.S. international treaty obligations by adopting rules that will enable the provision of UMFUS in the 28 GHz band.”⁷ A few paragraphs later, the Commission, despite noting that even internal U.S. studies of the aggregate impact are inconclusive and preliminary, contradicted its initial statement by asserting that the satellite industry has not shown that it has a legal right to protection from aggregate interference or that harmful interference is likely to occur.⁸ It directed further study and reserved the right to revisit the issue in the future.⁹

⁵ *Id.*, at 3. Lockheed Martin stated that:

It is the treaty obligation of the United States, with ultimate responsibility internationally falling to the Department of State, to ensure that recorded frequency assignments of other countries are taken into account when making U.S. assignments, and if harmful interference to the reception of any stations whose assignment is operating in accordance with the Radio Regulations is actually caused by the use of a U.S. frequency assignment not in conformity with the Radio Regulations, “the station using the latter frequency must, upon receipt of advice thereof, immediately eliminate this harmful interference.”

Id. (citing ITU Radio Regulations, Nos. 8.3 and 8.5).

⁶ *Report and Order*, FCC 16-89, slip op. at 25 (¶ 62 n.135).

⁷ *Id.*

⁸ *Id.*, at 29 (¶ 69).

⁹ *Id.*

The Commission’s response to this important issue regarding treaty obligations of the United States must be reconsidered. No party leading up to the *Report and Order* argued that mere adoption of rules for UMFUS operations at 28 GHz would violate an international treaty, and Lockheed Martin does not do so now. Indeed, Lockheed Martin firmly recognizes the United States’ sovereignty over radio usage entirely within the nation’s borders (*i.e.*, with no international impacts). Lockheed Martin and other parties argued that the Commission, *if* it were to adopt rules, must impose adequate regulatory safeguards – through conditionality or power limits – that enable the United States to meet its treaty obligation to “immediately eliminate . . . harmful interference” from UMFUS transmitters in the United States to non-U.S.-licensed FSS receiving space stations should such interference occur. While the Commission recognized the overall obligation, and even acknowledged that the issue had not been studied to resolution by contemplating a separate docket to further examine the aggregate interference issue, it failed to take any steps to preserve the ability of the United States to meet this obligation *now*.

It is critical that future UMFUS licensees understand how they will be expected to implement such a requirement, as they contemplate and deploy future 5G architectures in the 28 GHz band. Even considering that the possibility of harmful interference from aggregate UMFUS emissions has not yet been agreed upon, the question is what the Commission should do to ensure that the United States would be able to meet its obligations under an international treaty in the event of such interference. The Commission’s failure to act under the circumstances was not and is not a viable option, as the Commission did not (and indeed could not) conclude that it would have the ability to eliminate harmful interference from UMFUS operations licensed under the framework adopted in the *Report and Order*. Lockheed Martin, therefore, supports the positions of SES and O3b that the Commission should proceed to consider and establish, if appropriate,

mechanisms to address occasions of harmful interference from UMFUS terminals into an international FSS satellite receiver at 28 GHz, including potential UMFUS license conditions.¹⁰

B. The Commission Should Take Other Steps to Ensure Its Rules Align with ITU Requirements

As noted above, Lockheed Martin firmly recognizes that the United States' national sovereignty on spectrum decisions that only impact other U.S. domestic services is preserved under the ITU Radio Regulations. However, the United States, and thus the Commission, must adhere to international treaty obligations when establishing domestic regulations that may impact non-domestic services operating in accordance with the Radio Regulations. Moreover, the United States, on behalf of U.S. economic or security interests, often contributes to the development of many ITU Radio Regulations.

ITU Radio Regulation No. **21.5** places a limit of 10 dBW (40 dBm) on the power delivered by the transmitter to the antenna of a station in the fixed or mobile services in any frequency band above 10 GHz and provides a minimum level of protection for international space station receivers in the 28 GHz band. In the run-up to the issuance of the *Report and Order*, OneWeb¹¹ identified the importance of this international requirement in an *ex parte* presentation to the Commission. However, in the *Report and Order*, the Commission did not address this obligation. Furthermore, the Commission adopted UMFUS EIRP limits without any skyward constraints or emission limits

¹⁰ SES/O3b Petition for Reconsideration, at 20.

¹¹ WorldVu Satellites Ltd/OneWeb *Ex Parte* Presentation, GN Docket No. 14-177, et al. (filed Jul. 7, 2016) (“OneWeb July 7 Ex Parte”) at 4.

that could be used as a basis for demonstrating that it satisfies the intent of ITU Radio Regulation No. **21.5**. SIA petitioned the Commission to reconsider this aspect of the *Report and Order*.¹²

Without any skyward constraints, it is unclear how the international power limit will be observed and the protections of FSS stations inherent in ITU Radio Regulation **21.5** will be achieved. Lockheed Martin supports SIA's Petition that the Commission adopt a limit of 10 dBW on power delivered by a transmitter to the antenna of a UMFUS station. Although SIA's Petition indicates that this measure should help reduce the probability that harmful interference would occur and would provide a better balance between FSS and UMFUS operations, it also recognizes that adoption of this limit would not ensure protection of co-primary satellite receivers in all instances. Lockheed Martin thus submits that adoption of the limit urged by SIA – together with appropriate license conditions as discussed above – better reflects a treaty obligation that has no exception to its application.

C. The Commission Should Prohibit the Use of Omni-Directional Transmit Antennas in the 28 and 37/39 GHz Bands

As Boeing observes in its Petition,¹³ the specific language in Section 30.406(a) of the Commission's rules permits authorization "as necessary" for omni-directional transmit antennas. Lockheed Martin agrees that this exception goes against the record of potential uses for the UMFUS bands. Planning for new systems and effective sharing would be greatly inhibited by the potential for omni-directional transmitters. Permitting them may encourage deployment of systems that undermine robust frequency re-use in the bands and make it more difficult to protect users who responsibly deploy directional antennas in these mmW bands conforming to the limits

¹² SIA Petition for Reconsideration, at 12-13.

¹³ The Boeing Company Petition for Reconsideration, at 20.

of the table in Section 30.406(b). Specifically, omni-directional transmit antennas present potential interference to *all* other services that may use the 28 GHz, 37 GHz, or 39 GHz bands, whether terrestrial, airborne, or satellite. A powerful approach for spectrum re-use, which can permit co-existence of FSS, emerging airborne services, and current and future terrestrial applications, is geometric separation. Allowing omni-directional antennas would undermine the natural propagation characteristics of the 28 GHz, 37 GHz, and 39 GHz bands which favor highly directional applications and increased opportunities for sharing. An elevation-based power flux density limit on terrestrial systems, with their typically low elevation paths, would (with appropriate waivers to handle exceptional cases) enable effective sharing of the spectrum with overhead systems – whether satellite or airborne – with their relatively higher elevation paths. Omni-directional antennas would undermine the purpose of such an interface definition and should be specifically prohibited in bands where advanced technologies allowing directional antennas are baselined. Lockheed Martin supports the view expressed by Boeing to remove the exception in Section 30.406(a) that allows the use of omni-directional transmit antennas in the 28 GHz, 37 GHz, and 39 GHz bands.

D. The Commission Should Maintain a Database of UMFUS Operations to Improve Effective Spectrum Sharing and to Assist FSS Planning

As the SES/O3B Petition¹⁴ observes, under the *Report & Order* UMFUS licensees are not required to register or notify the public until they have met their performance requirements. In the case of FSS earth station deployments around UMFUS, this lack of information burdens and could potentially delay effective satellite infrastructure planning and can lead to long, repeated coordination efforts. SES/O3B explains how it establishes a trial and error system for FSS earth

¹⁴ SES/O3b Petition for Reconsideration, at 17-18.

station planning, unnecessarily increasing the time and investment needed for their infrastructure deployment by preventing early access to essential planning information. More generally, the absence of general information regarding users of the band makes it difficult for emerging systems in the band to effectively plan for sharing so as to increase the utility of the spectrum resource. With the wide variety of applications that can be deployed in these and all other higher frequency bands envisioned for high density shared use, planning requires some degree of knowledge of the potential interference paths affecting terrestrial, airborne, and satellite links. Note that it is particularly important in a band such as 37-37.6 GHz that has a non-exclusive licensing access mechanism to facilitate innovation. Thus, Lockheed Martin supports that databases identifying stationary UMFUS stations and typical user densities of mobile stations within defined areas be established. Lockheed Martin also recognizes the competitive sensitivity of this kind of commercial information, and thus the need to ensure that the database protects that information.

CONCLUSION

To address the above, the Commission should modify its *Report and Order* on reconsideration by (1) incorporating its proposed separate docket to consider the issue of potential aggregate interference into this docket; (2) developing a standard condition for all UMFUS licenses in the 28 GHz band, as appropriate, to eliminate immediately any harmful interference if it were to occur – including harmful aggregate interference – to non-U.S. FSS space stations; (3) adopting the ITU 10 dBW per-station power limit of ITU Radio Regulation **21.5** to UMFUS stations in the 28 GHz band; (4) prohibiting the use of omni-directional transmit antennas in the 28 GHz, 37 GHz, and 39 GHz bands; and (5) establishing an appropriate database of UMFUS operations. In reaching the right balance in this docket and on the issues discussed herein, the

Commission should recognize that a variety of terrestrial, airborne, and satellite system architectures may emerge in order to maximize use of the spectrum resources made available by the Commission in these bands.

Respectfully submitted,

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